

1 CLAIMS:

2 1. A method of treating portions of an array of substantially
3 upright silicon-comprising structures, comprising:

4 providing a substrate having a plurality of substantially upright
5 silicon-comprising structures extending thereover, the substantially upright
6 silicon-comprising structures having base portions and end portions above
7 the base portions;

8 forming a masking layer over the substrate, the masking layer
9 covering the base portions of the substantially upright silicon-comprising
10 structures and leaving the end portions exposed; and

11 while the masking layer covers the base portions, subjecting the
12 exposed end portions to conditions which alter the end portions relative
13 to the base portions.

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15 2. The method of claim 1 wherein the forming comprises:

16 depositing the masking layer over the substrate to have a greater
17 thickness over the base portions than over the end portions; and

18 removing the deposited masking layer from over the end portions
19 to expose the end portions.

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21 3. The method of claim 1 wherein the masking layer comprises
22 spin-on-glass.
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1 4. The method of claim 1 wherein the masking layer comprises
2 silicon dioxide.

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4 5. The method of claim 1 wherein the subjecting comprises
5 subjecting the end portions to conditions which render the end portions
6 more porous than the base portions.

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8 6. The method of claim 5 wherein subjecting comprises
9 electrochemical etching in the presence of HF.

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11 7. The method of claim 5 wherein the silicon of the upright
12 structure is doped with an n-type material, and wherein the subjecting
13 comprises electrochemical etching in the presence of HF and light.

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15 8. The method of claim 5 wherein the silicon of the upright
16 structure is doped with an p-type material, and wherein the subjecting
17 comprises electrochemical etching in the presence of HF.

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19 9. The method of claim 1 wherein the subjecting comprises
20 subjecting the end portions to conditions which cover the end portions
21 with a coating material.

10. The method of claim 9 wherein the coating material comprises a lower work function than silicon.

11. The method of claim 9 wherein the coating material comprises diamond.

12. The method of claim 9 wherein the coating material comprises boron nitride.

13. The method of claim 9 wherein the coating material comprises sulfur-doped boron nitride.

14. The method of claim 9 wherein the coating material comprises cesium.

15. The method of claim 9 wherein the coating material comprises cesiated carbon.

1 16. A method of treating the ends of an array of silicon-
2 comprising emitter structures, comprising:

3 providing a substrate having a plurality of silicon-comprising emitter
4 structures thereover, the emitter structures having base portions and ends
5 above the base portions;

6 forming a layer over the substrate, the layer covering the base
7 portions of the emitter structures and leaving the ends exposed; and

8 while the layer covers the base portions, subjecting the ends to
9 conditions which alter the ends relative to the base portions.

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11 17. The method of claim 16 wherein the subjecting comprises
12 subjecting the ends to conditions which render the ends more porous
13 than the base portions.

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15 18. The method of claim 17 wherein subjecting comprises
16 electrochemical etching in the presence of HF.

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18 19. The method of claim 17 wherein the silicon of the upright
19 structure is doped with an n-type material, and wherein the subjecting
20 comprises electrochemical etching in the presence of HF and light.
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20. The method of claim 17 wherein the silicon of the upright structure is doped with an p-type material, and wherein the subjecting comprises electrochemical etching in the presence of HF.

21. The method of claim 16 wherein the subjecting comprises subjecting the ends to conditions which cover the ends with a coating material.

22. The method of claim 21 wherein the coating material comprises a lower work function than silicon.

23. The method of claim 21 wherein the coating material comprises diamond.

24. The method of claim 21 wherein the coating material comprises boron nitride.

25. The method of claim 21 wherein the coating material comprises sulfur-doped boron nitride.

26. The method of claim 21 wherein the coating material comprises cesium.

1 27. The method of claim 21 wherein the coating material
2 comprises cesiated carbon.

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4 28. A method of treating the ends of an array of silicon-
5 comprising emitter structures, comprising:

6 providing a substrate having a plurality of silicon-comprising emitter
7 structures thereover, the emitter structures having base portions and
8 pointed apexes above the base portions;

9 forming a layer of spin-on-glass over the substrate, the layer of
10 spin-on-glass covering the base portions of the emitter structures and
11 leaving the apexes exposed; and

12 while the layer of spin-on-glass covers the base portions, subjecting
13 the apexes to conditions which alter the apexes relative to the base
14 portions.

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16 29. The method of claim 28 wherein the subjecting comprises
17 subjecting the apexes to conditions which render the apexes more porous
18 than the base portions.

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20 30. The method of claim 29 wherein subjecting comprises
21 electrochemical etching in the presence of HF.
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1 40. The method of claim 39 further comprising removing the
2 spin-on-glass from over the base portions prior to joining the base plate
3 to the face plate.
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5 41. The method of claim 39 wherein the spin-on-glass is not
6 removed from over the base portions prior to joining the base plate to
7 the face plate.
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9 42. The method of claim 39 wherein the ends terminate in sharp
10 apexes before the subjecting.
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12 43. The method of claim 39 wherein the subjecting comprises
13 subjecting the ends to conditions which render the ends more porous
14 than the base portions.
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16 44. The method of claim 43 wherein subjecting comprises
17 electrochemical etching in the presence of HF.
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19 45. The method of claim 43 wherein the silicon of the upright
20 structure is doped with an n-type material, and wherein the subjecting
21 comprises electrochemical etching in the presence of HF and light.
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1 46. The method of claim 43 wherein the silicon of the upright
2 structure is doped with an p-type material, and wherein the subjecting
3 comprises electrochemical etching in the presence of HF.
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5 47. The method of claim 39 wherein the subjecting comprises
6 subjecting the ends to conditions which cover the ends with a coating
7 material.
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9 48. The method of claim 47 wherein the coating material
10 comprises a lower work function than silicon.
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12 49. The method of claim 47 wherein the coating material
13 comprises diamond.
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15 50. The method of claim 47 wherein the coating material
16 comprises boron nitride.
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18 51. The method of claim 47 wherein the coating material
19 comprises sulfur-doped boron nitride.
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21 52. The method of claim 47 wherein the coating material
22 comprises cesium.
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1 53. A cathode assembly comprising a plurality of silicon-
2 comprising emitter structures projecting over a substrate, the emitter
3 structures having base portions and ends above the base portions, the
4 ends comprising a different material than the base portions.

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6 54. The assembly of claim 53 wherein the emitter structures
7 comprise conductively doped polysilicon.

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9 55. The assembly of claim 53 wherein the ends terminate in
10 pointed apexes.

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12 56. The assembly of claim 53 wherein the emitter structures
13 consist essentially of conductively doped silicon.

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15 57. The assembly of claim 53 wherein the emitter structures
16 consist essentially of conductively doped polysilicon.

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18 58. The assembly of claim 53 wherein the ends comprise porous
19 silicon and the base portions comprise non-porous silicon.
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